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Pelagic Fisheries Research Program

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Managing Highly Migratory Species

PFRP Principal Investigators assemble twice a year to discuss progress on research projects. Occasionally, PI meetings are coupled to larger gatherings at which fisheries experts from other organizations and other parts of the world present related research. In November 1995, the PI meeting expanded to a three-day symposium that reviewed current research on pelagic fisheries in the Pacific (Sibert J. and M. Nunn, editors. 1996. Pacific pelagic fisheries: current progress and related research. JIMAR contribution 96-299).

The 1995 United Nations agreement on management of highly migratory species has set the stage for real changes in pelagic species management in the Pacific. Negotiations are currently underway among Pacific fishing interests to establish new management arrangements in the Pacific. These arrangements, regardless of their actual forms, will impose challenges for researchers. Foremost among these challenges is to determine appropriate policies to apply to management of fisheries for resources that occupy the Pacific Ocean, the largest single feature of our planet, from shore to shore.

In November 1997, a group of economists, social scientists and legal experts discussed these questions at a PFRP PI meeting. This issue of the PFRP newsletter presents abstracts of talks from two of the invited speakers. Future issues will present results from PFRP projects that will be relevant to the development of ocean-basin scale policies for fisheries management.

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Participants at the PFRP Principal Investigators Meeting, Nov. 1997: (Front) John Sibert, Paul Bartram, Dodie Lau, John Kaneko, Judith Swan, David Itano; (2nd row) Paul Callaghan, Craig MacDonald, Robert Skillman, Marcia Hamilton, Michael Travis, Craig Severance, Richard Brill; (3rd row) Charles Daxboeck, Patrick Bryan, Keiichi Nemoto, Ujjayant Chakravorty, Harry Campbell, Cheryl Anderson, Minling Pan; (4th row) Sam Herrick, Sam Pooley, Tom Pinhey, Marc Miller, PingSun Leung, Knut Heen, Khem Sharma, Fang Ji. (Not shown) Tony Kingston, Stuart Nakamoto, Shankar Aswani, Ed Glazier, Michael Seki, Ray Clarke, Jeff Nagel, Thomas Kraft, Deane Neubauer, Dan Curran, Mike Musyl, Scott Miller, Rose Pfund, Bob Franco.

Legal Considerations for Managing Highly Migratory Fish

As circumstances and needs change, so must the law and legal arrangements, contends attorney Judith Swan, of SwanSea Ocean Environment Inc. Below is a summary of her arguments presented at the PFRP Principal Investigators Meeting's Workshop on Ocean-Scale Management of Pelagic Fisheries, Nov. 12 and 13, in Honolulu. Her comments are based on examination of fisheries legislation in more than 40 countries.

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Global Perspective

Radical changes in the world's fisheries have occurred since negotiations began in 1973 towards the United Nations Law of the Sea Convention. These changes—in scientific knowledge, fishery profile, technology, economies, subsidies, food security, developmental assistance, private-sector investment, trade and market forces—are driving the need for a new look at policies for management of highly migratory fish.

As the ocean was carved into 200-mile exclusive economic zones, many governments passed laws to manage the resource over which they claimed sovereign rights. They also subsidized, often heavily, the development of national fishing industries.

Two decades later, 70 percent of the world's fisheries were fully to heavily exploited, depleted or slowly recovering from overfishing, according to the Food and Agriculture Organization (FAO) of the United Nations. The FAO also concluded that the global value of the fish caught was lower than the expenditure used to catch it and that 60 percent of the world's major fishery resources needed urgent management.

The situation prompted restructuring of national fisheries sectors, downsizing of many distant water fleets and introduction of new management measures (such as individual transferable quotas) and new initiatives in fisheries enforcement (including increasing use of transponders). Perhaps most importantly, it alerted coastal states that fisheries management inside and outside the 200-mile zones had substantially failed and that new laws would be needed.

Regional Perspective

In the Western Central Pacific, where governments had established the South Pacific Forum Fisheries Agency to assist in harmonizing management measures and resourced programs at the South Pacific Commission for scientific information and advice, the tuna resource appears to be comparatively healthy. The FAO projects that the Pacific Ocean will not be fully fished until 1999. However, management has been loose, and it is unwise to remain complacent as the fishery faces a variety of changes:

- The impacts of the aforementioned global trends on the region, including downsizing and downsubsidizing—even bankruptcy—of fleets;
- The modernization of some distant water fleets and increasing interest shown by newer entrants to find productive fishing grounds;
- The increasing domination of tuna harvesting by distant water countries;
- The general decrease in developmental assistance, including the expiration of funding from the United States to the Micronesian countries under the Compact of Free Association in another four years; and
- Recently adopted policies in Micronesia recognizing that far greater revenues than just the rent (about $60 million in annual license fees in 1995 for landed fish valued at $1.7 billion, which represents about a 3.5 percent return) are available from the fishery through onshore services, such as provisioning and servicing vessels.

In short, the days are fading where benefits from the fishery could be realized largely from license fees from offshore fleets and management was commensurately easy. New objectives and goals need to be creatively set, and management of the resource needs to acquire a broader breadth in most cases. The legal implications are far-reaching as new potential benefits and policies are identified.

Below is a historical overview of the legal framework and policy focus in the region during the past two decades.

(a) The Offshore Eighties

In the 1980s, national laws in the Pacific Island states developed around three building blocks.

- 1982 United Nations Convention on the Law of the Sea: Negotiated at a time when uniform standards and rules were needed for managing the new 200-mile exclusive economic zones, it focused on setting appropriate level of catch and regulating and enforcing in-zone activities.
- Treaty on Fisheries with the United States: Concluded in the region as a result of an "invasion" by more than 60 unlicensed U.S. purse seiners in the early eighties, the treaty inspired a high regional standard for management of the offshore purse-seine fleet, and its provisions were incorporated into most national laws.
- Nauru Group minimum terms and conditions of fisheries access: Harmonizing law in the region, the focus was the offshore fleet.

Using these three building blocks, national laws initially featured a management framework that focused on licensing requirements—and fees—for foreign fishing vessels. The fees—a quantifiable amount that could be in the seven- or eight-figure range—provided a centerpiece for government revenue.

Extensive provisions on the duties of and rights owed enforcement officers and observers were included, and many countries authorized non-national enforcement officers and observers to perform duties in their jurisdictions. The levels of fines and penalties were increased to reflect the value of the resource to island countries. In some jurisdictions, fisheries managers did not have lead responsibility for enforcement and were put in the unenviable position of having to establish good relations with the distant water fleet to attract the fleet and a reasonable fee level while another arm of government carried out enforcement activities. In some cases, offenders were given onerous fines for relatively minor offenses.

In summary, national laws originally were license (and license fee) oriented, with strong controls over foreign fleets. Development did not, for the most part, embrace the industry as a whole with a view to securing higher profits from the foreign fishery operations nor did it encourage private-sector investment through simplified procedures or laws.

(b) The New Nineties

New fisheries policies recently adopted in Micronesia have concluded that it is time for change: development priority should be put on profits rather than rents; management authority should be consolidated under one canopy; and governments should stick to the business of resource management and encourage private-sector investment to drive the development of the fishery.

To implement these policies, Micronesian countries are reviewing and amending national fisheries and related legislation. To attract profits as well as rents, the new laws accord domestic-based vessels advantages over an offshore fleet (such as priority to any allocations and rebates in fees), make viable long-term arrangements possible and provide for strong but reasonable enforcement.

At the sub-regional level, the importance of domestic-based vessels is reflected in the recent Palau and Federated States of Micronesia (FSM) arrangements. Incorporating sub-regional standards for access, they are designed to manage the purse-seine fishery by capping the number of vessels allowed to fish, increasing domestic-based and local fishing vessels and issuing one license for fishing in the zones of the parties.

(c) Current Developments

A surge of legal activity in the region—on both the national and international levels—should flow from the 1995 United Nations agreement on straddling fish stocks and highly migratory fish stocks.

At the national level, areas ripe for consideration of law reform include the following:

- phasing out of government in fisheries management and operations in favor of the private sector;
- framing laws that ensure maximum economic return on the resource (for example, satisfying the U.S. Hazardous Assessment and Critical Control Point requirements and those of other export markets);
- setting minimum standards for license fees;
- developing appropriate infrastructure and a minimal legal/bureaucratic process that will attract domestic-based fleets;
- reviewing and reforming investment laws and guidelines;
- reforming enforcement policy and activities so fisheries management authorities have the lead in setting enforcement policy or guidelines; and
- ensuring adequate provision for cooperation in fisheries surveillance and enforcement, including the use of transponders.

At the international level, there is the agreement on establishment of a management mechanism through the Multilateral High Level Conference (MHLC) process. Nationally, some countries (including the FSM, the Republic of the Marshall Islands and the United States) are incorporating the relevant requirements of the UN agreement in their laws, including adoption of the precautionary approach, licensing vessels for fishing on the high seas and authorizing high seas boarding/inspection measures.

The reforms should be implemented at an early time by all countries in the region because they enhance management and provide a sound basis for consistent management throughout the region, and they give the countries higher moral and legal ground in the MHLC process. For the same reasons, the reforms should be coupled with ratification of the UN agreement by those states that have not yet done so.

Ambassador Satya N. Nandan, chairman of MHLC and secretary general of the International Seabed Authority, emphasized the need for globalization of fisheries management in this recent statement at the Canadian Summit of the Sea: "Fisheries is part of the global commons. It must be the object of global governance. ... The sustainable use of fisheries resources, wherever they are found, is a matter of vital concern to all mankind."

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The Importance of Tuna to the Pacific Islands

For a variety of economic and social reasons, Pacific Island countries are dependent on their tuna resources. That dependence is bound to grow, argues Tony Kingston, manager of the Economics and Marketing Program at the Forum Fisheries Agency (FFA). Below is a summary of his presentation given at the PFRP Principal Investigator's Meeting Workshop, Nov. 12 and 13, in Honolulu.

Industrial-Scale Tuna Fishing

The tuna catch from the Pacific Islands is globally significant. Having increased tenfold in the last 25 years (Figure 1), it currently averages 996,000 metric tonnes annually and makes up about one-third of the 3.1 million metric tonnes of tuna caught each year worldwide. In comparison, the other major tuna fishing areas of the world—the eastern Pacific, west Africa and the western Indian Ocean—land 450,000 mt, 335,000 mt and 350,000 mt annually, respectively (Figure 2).

The importance of the region's tuna harvest to the island nations is equally significant. The current $1.7 billion value of the annual catch represents about one-tenth of the approximately $16 billion combined gross domestic product of all of the nations of the region and more than one-third of the $4.3 billion value of all exports from the region. The Pacific Island tuna fishery also produces more than nine times the amount of fish as all of the other fisheries in the region combined and is worth more than six times that of all other fisheries combined (Table 1, page 6).

One of the major financial benefits from the Pacific Islands tuna resource is the access fees that are paid by foreign fishing vessels for the privilege of fishing in the region. During the 1995–1996 licensing period, a total of 1,332 foreign fishing vessels were listed on the FFA Regional Register of foreign fishing vessels eligible for licensing (Table 2). The $66 million of revenue received (Table 3) represents a sizable portion of the total government revenue. For example, access fees amounted to about 25 percent of government revenue in both the Marshall Islands and the Federated States of Micronesia (FSM).

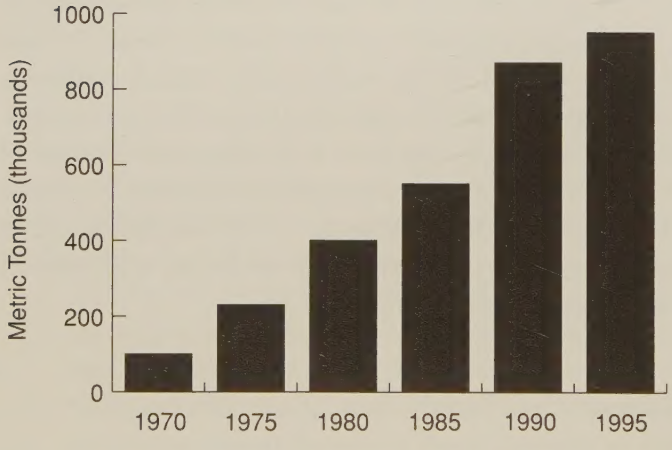

Figure 1. Tuna catches in the Pacific Islands area.

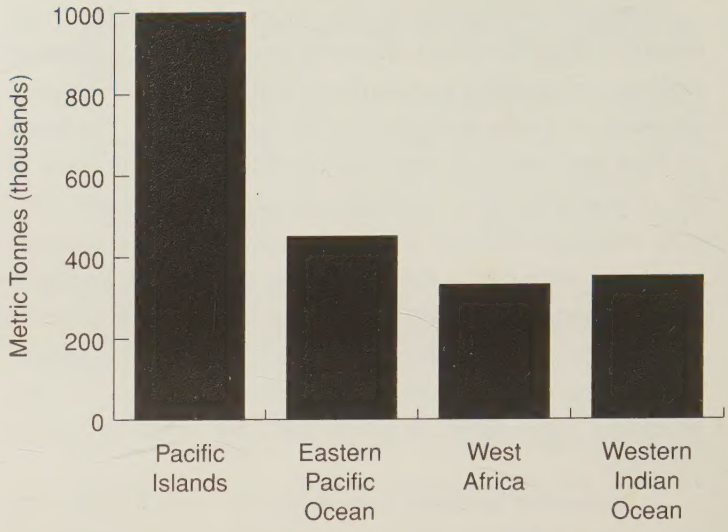

Figure 2. The relative volumes of the major tuna fishing areas.

Another crucial benefit of the tuna fishery to the Pacific Island countries is in job creation. More than 10,000 jobs are directly related to the industry (i.e., on fishing vessels and in fish processing operations), and an additional 11,000 to 21,000 jobs are estimated to be either connected to the tuna industry (e.g., those at the purse-seine net repair facility in Yap) or indirectly linked to it (e.g., those that provide services and goods—such as shoes, food, transportation and entertainment—to employees in the tuna industry). With only 370,000 wage earning job opportunities available in the Pacific region (1991 estimates), tuna-related jobs represent between 6 and 8 percent of the total number of wage employment in the Pacific Islands region.

Although job generation is often the most visible and appreciated benefit to the local economies, there are many other gains provided by the 30 purse seiners, 40 pole/line and about 320 longliners based in the region. A tuna seiner reportedly spends $300,000 to $450,000 on each visit to the home port (four to five port calls would be the usual). A locally based sashimi longliner doing short trips would spend

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Pacific Pelagic Fisheries: Current Projects and Research, Abstracts of Papers Presented November 28–30, 1995, by John Sibert and Mary Nunn, SOEST 96-01, JIMAR 96-299.

Feasibility of Dual Mode Lidar for Pelagic Fish Surveys, by Christian Schoen and John Sibert, SOEST 96-02, JIMAR 96-301.

Cost-Earnings Study of the Hawaii-Based Domestic Longline Fleet, by Marcia Hamilton, Rita Curtis and Michael Travis, SOEST 96-03, JIMAR 96-300.

Social Aspects of Pacific Pelagic Fisheries, Phase I: The Hawai'i Troll and Handline Fishery, by Marc Miller, SOEST 96-04, JIMAR 96-302.

The Contribution of Tuna Fishing and Transshipment to the Economies of American Samoa, the Commonwealth of the Northern Mariana Islands, and Guam, by Michael Hamnett and William Sam Pintz, SOEST 96-05, JIMAR 96-303.

Quality and Product Differentiation as Price Determinants in the Marketing of Fresh Pacific Tuna and Marlin, by Paul Bartram, Peter Garrod, and John Kaneko, SOEST 96-06, JIMAR 96-304.

Sociology of Hawaii Charter Boat Fishing, by Julie Walker, SOEST 97-02, JIMAR 97-309.

Design of Tag-Recapture Experiments for Estimating Yellowfin Tuna Stock Dynamics, Mortality, and Fishery Interactions, by Peter Bills and John Sibert, SOEST 97-05, JIMAR 97-313.

Cost-Earnings Study of Hawaii's Small Boat Fishery, 1995–1996, by Marcia Hamilton and Stephen Huffman, SOEST 97-06, JIMAR 97-314.

Upcoming Events

January 24-February 7

Bigeye Tuna Working Group
La Jolla, California (contact: Robin Allen, Inter-American Tropical Tuna Commission, 8604 La Jolla Shores Dr., La Jolla, CA 92037-1508; e-mail: rallen@iattc.ucsd.edu)

May 18-21

49th Annual Tuna Conference
Lake Arrowhead, California (contact: Christofer Boggs, National Marine Fishery Service, Honolulu Laboratory, 2570 Dole Street, Honolulu, HI 96822-2396; tel: 1-808-943-1222; fax: 1-808-943- 1290; e-mail: cboggs@honlab.nmfs.hawaii.edu)

May 24-29

1998 Ocean Circulation and Climate—The 1998 WOCE Conference
Halifax, Nova Scotia, Canada (contact: John Gould, WOCE IPO, Southampton Oceanography Centre Room 256/18, Empress Dock, Southampton, SO14 3ZH, UK; tel: 44-1703-596789; fax: 44-1703-596204; e-mail: woceipo@soc.soton.ac.uk; http://www.soc.soton.ac.uk/others/woceipo/wconf)

June 1-6

Standing Committee on Tuna and Billfish
Honolulu, Hawai'i (contact: A. D. Lewis, Offshore Fisheries Programme, South Pacific Commission, Noumea, New Caledonia; tel: 687-26-2000; fax: 687-26-3818; e-mail: tonyl@spc.org.nc)

June 15-19

PACON 98 Conference on the 8th Pacific Congress on Marine Science and Technology, "Toward the 21st Century—The Pacific Era"
Seoul, Korea (contact: PACON International, P.O. Box 11568, Honolulu, HI 96828-0568; tel: 1-808-956-6163; fax: 1-808-956-2580; e-mail: pacon@wiliki.eng.hawaii.edu)

June 20-25

2nd International Symposium on Fish Otolith Research and Application
Bergen, Norway (contact: Oto-98, Institute of Marine Research, Flodevigen Marine Research Station, N-4817 His, Norway; fax: 47-37-05-9001; e-mail: symp98@flode.imr.no; http://www.imr.no/sear/oto98.html)

Importance of tuna (continued from page 4)

$13,000 each trip, and a fleet of 60 such vessels would generate $8 million annually in home port expenditures. A Pacific Island based pole/line vessel would normally spend about $425,000 locally each year. A rough approximation of expenditures by all tuna vessels based in FFA member countries would approach $100 million. The portion of this figure which is actually benefiting Pacific Island economies could be expected to increase as more local businesses develop to cater to the tuna vessels.

In addition to the economic benefits from locally based tuna vessels, substantial gains accrue from vessels that occasionally visit ports in the region to transship fish. After FFA member countries introduced a ban on transshipment at sea, port activity at transshipment points increased remarkably, particularly in the FSM, the Solomon Islands and Papua New Guinea (PNG). The benefits of transshipment in the FFA member countries in the first full year of operation (1994) are estimated at $1.5 million in charges and $10 million in expenditure. As local businesses grow to cater for this trade, it is likely that the local expenditures would increase and a greater percentage of those expenditures would be retained within the countries.

Other benefits of locally based and transshipping vessels to the economies include the acquisition of foreign exchange and the generation revenue from fines. Tuna exports represent a substantial portion of all exports in Fiji, Kiribati, FSM, Marshall Islands and Palau.

The benefits from industrial-scale tuna fishing to FFA Pacific Island member economies are large: $66 million in access fees; 21,000 to 31,000 jobs; expenditures by locally based vessels approaching $100 million; and expenditure of approximately $11.5 million from vessels visiting ports to transship fish, as well as other substantial miscellaneous benefits.

Small-Scale Tuna Fishing

Without a doubt, fish is extremely important in the diet of the average Pacific Islander. The regional per capita consumption is about 55 kg per year, while the world average is 13.32 kg. Tuna makes up a substantial portion of all fish consumed, especially in the most vulnerable countries of the region, several of which are categorized as Low Income Food Deficit Countries: PNG, Kiribati, Tuvalu, Solomon Islands, Vanuatu and Western Samoa.

Tuna forms a substantial component of the catch of both the subsistence and artisanal fisheries in the Pacific Islands. About 30 percent of the 80,000 mt of fish caught annually by subsistence fisheries in the region are pelagic species, with the vast majority being various tunas.

Category	Volume (mt)	Value (US$m)	Source
Industrial Tuna Fishery	996,000	1,700	SPC (1996), FFA (1996)
Industrial Prawn Fishery	594	5	NFA (1995)
Subsistence Fisheries	83,914	180	Dalzell et al. (1996)
Small-Scale Commercial Fisheries	24,327	82	Dalzell et al. (1996)
Total	1,104,835	1,967	

Table 1. Annual volumes/values of categories of Pacific Island fisheries.

Virtually all tuna caught by small-scale fisheries is consumed within the Pacific Islands. In addition, tuna caught by the industrial fishing fleets also enters the food supply. For example, about 20 percent of the production of the tuna cannery at Noro in the Solomon Islands is consumed domestically and about 11 percent of the tuna from the Levuka cannery in Fiji is sold on the local market.

The emergence of medium-scale tuna longline operations in most Pacific Island countries has resulted in damaged tuna, undersized tuna and by-catch being sold on domestic markets, with weekly sales of such fish in Fiji estimated at greater than 10 mt.

In addition to its importance as food, tuna has cultural significance on many islands, where it provides recreation, status in the community and cultural heritage.

The Future Importance of Tuna

For various reasons, it is inevitable that tuna will assume a much larger profile in the Pacific Islands in the medium- and long-term future. It is likely that the significance of tuna will rise in a number of sectors, but especially in the food security and economic development sectors.

Flag	Small Longliner (<100 grt)	Large Longliner (>100 grt)	Purse Seiner	Pole/ Line	Total
Japan	179	298	35	58	570
Korea	0	105	29	0	134
Taiwan	91	36	43	0	170
China	159	149	0	0	308
United States	1	5	48	0	54
Pacific Island	1	3	11	0	15
Philippines	0	0	13	0	13
Other	19	46	3	0	68
Total	450	642	182	58	1,332

Table 2. Numbers of fishing vessels on the regional register (licensing period 9/1/95 to 8/31/96).

	Longline	Pole/Line	Purse Seine	Total
Total	17	4	45	66

Table 3. Estimates of 1996 access fees paid to FFA member countries (US$m).

Between 1990 and 2010, the population of the region will increase from 6,068,000 to 8,871,060, or by 46 percent. This would result in a demand for fish of 166,776 mt in 2010, or 58,535 mt more than at present. Given the fully exploited nature of many of the region's inshore/coastal fisheries, especially in areas where the population increases will occur, major increases in fish from those areas is not expected. In fact, increased fishing effort, destructive fishing practices and degradation of coastal zone environments are likely to lead to a reduced amount of fish from inshore and coastal areas. The most likely scenario is that, in order to maintain nutrition standards, Pacific Island countries would have to make greater use of the region's tuna resources as food for their people.

For the Pacific Islands as a whole, economic growth during the past decade was almost nil. When this is combined with high population growth rates, the resulting outlook is gloomy. To make matters worse, the economies of the region will be facing additional difficulties due to severe shocks. Many countries will face the loss or diminishing benefits from preferential trade arrangements. In addition, it is likely there will be a winding down of development assistance to the region (currently $1.2 billion), reduction in remittance income from relatives overseas, reduced opportunity for emigration, termination of compact funds in Micronesia, depletion of forests in Melanesia, economic disruption from difficulties related to land tenure in Fiji and loss of phosphate income in Nauru.

To further complicate the economic situation, the future employment prospects are not promising. It is estimated that there are currently four to seven workers for each formal sector job. By 2011, there will be between five and nine workers for each formal sector job available.

In the future Pacific Island climate of very high population growth, economic stagnation, severe shocks and massive unemployment, it is inevitable that the presently underexploited tuna resources of the region will assume an importance very much greater than at present. Quite simply, in most countries there are few, if any, alternatives.

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School Behavior and Site Fidelity of Monitored Tuna

Yellowfin tuna that frequent fish aggregating devices in Hawaiian waters apparently travel in schools and are faithful to particular FADs, perhaps using them as regularly visited "way points" on a fixed foraging route. These findings are from a recent study by A. Peter Klimley of the Bodega Marine Laboratory, University of California—Davis, and Chuck Holloway of the Joint Institute for Marine and Atmospheric Research, University of Hawai'i at Mānoa. The study is based on remote sensing data of 40 tuna tagged with miniature pingers during 1996 and 1997 at the Romeo FAD and at a subsurface FAD near the 75-m isobath at Ka'ena Point off of the island of O'ahu (Figure 1).

Working closely with local sportfishermen, Klimley and Holloway caught the fish by handline and inserted the tags into an incision made in the belly of each fish. Upon return to the water, the fish were monitored by a submersible data logger placed on each buoy. The detection range of these monitors was roughly one kilometer. The monitors were removed briefly each month so the files of tuna attendance could be downloaded at the laboratory.

Analysis of files recorded during 16 months reveals that tuna often return to the buoys together. The simultaneous return of the tuna suggests they may arrive in schools and

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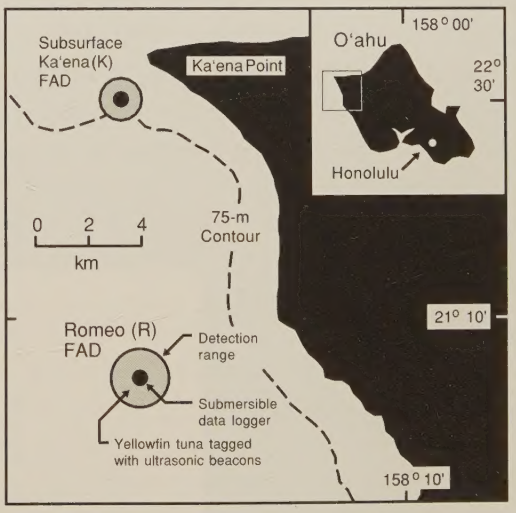

Figure 1. The locations of the Ka'ena and Romeo FADs where five yellowfin tuna were tagged with ultrasonic beacons on 6 March 1996 and monitored during a 10-month period. Circles indicate the signal-detection ranges of the two submersible data loggers.

School behavior (continued from page 7)

not as an assembly of widely separated individuals. For example, five tuna that were tagged between 0930 and 1400 at the Romeo FAD on March 6, 1996, returned to the FAD 35 times during a period of nine months. Two or more visited the FAD together on 23 of these occasions. All five individuals visited the FAD on April 11, roughly one month after tagging. Three arrived together five months later on August 4, and three also returned six months later on December 1, 1996. Even more striking was the synchronicity of the visits. For example, three arrived at 0945 hours on March 19; all five arrived between 0930 and 1000 hours on April 11; and two or more appeared at the same time during August, September and December (Figure 2).

The tagged tuna also exhibited considerable site fidelity. Those tagged at Romeo returned often to that FAD but rarely to the nearby subsurface Ka'ena FAD. Similarly, those tagged at Ka'ena were faithful to that FAD and rarely visited Romeo.

A next step would be to obtain records of the long-term movements of yellowfin tuna between their visits to the FADs. This may be possible in the near future by using archival tags that store a fish's daily positional coordinates and transmit them by ultrasonic MODEM to a listening station upon return to an aggregation site, such as a FAD.

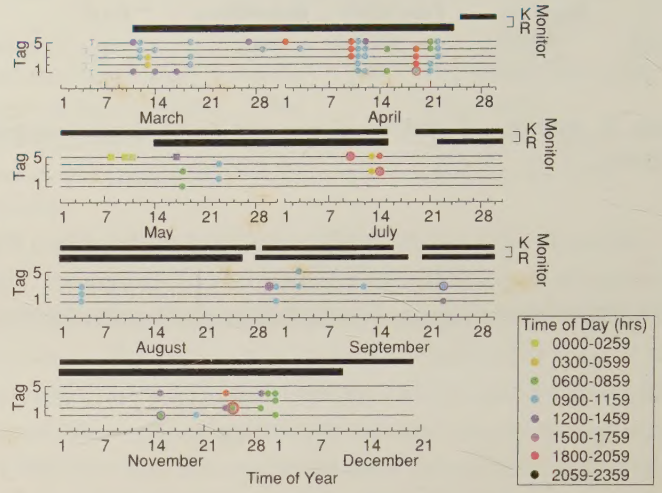

Figure 2. Chronology of daily visits of five yellowfin tuna to the Ka'ena (squares) and Romeo (circles) FADs. The five horizontal lines above the ordinate indicate when the fish were at large. The color of each symbol denotes the time of detection. Solid bars indicate when the data loggers were deployed and "listening" for beacons.

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